Claim Amendments

Please amend claims 4, 21, 22, 28 and 29 and add new claim 31 as follows:

1. (canceled)

2. (canceled)

3. (previously amended)   The method of claim 4, wherein said forming comprises:

for each of said rectangular blocks of coefficients and each permutation of a horizontal offset value X and a vertical offset value Y, obtaining M additional rectangular blocks of coefficients for providing M reference blocks, wherein each of said M reference blocks of coefficients is formed by selecting coefficients from the M reference frames, such that the coefficients in the M reference blocks of coefficients are horizontally offset by distance X and vertically offset by distance Y from a corresponding coefficient in said rectangular block of coefficients.

4. (currently amended)   A method comprising:

selecting M reference frames for a given original video frame from a video sequence having a plurality of video frames, each frame containing a plurality of coefficients, wherein M is a positive integer equal to or greater than 1;

partitioning said original video frame into rectangular blocks of coefficients; and

from each of the M reference frames:

forming at least one reference block of coefficients from an offset of the rectangular blocks; and

obtaining a block difference at least partially from a summation of absolute values of differences between corresponding individual coefficients in [[in]] each of said rectangular blocks of coefficients and corresponding individual coefficients in said at least one reference block of coefficients; and

optimizing the offset at least partially based on the block difference.

5. (original)   The method of claim 4, wherein said optimizing comprises:

for each of said rectangular blocks of coefficients, determining an optimal horizontal offset X and vertical offset Y, wherein said determining is based at least partially on minimizing a weighted sum of M block differences.

6. (previously presented) The method of claim 4, wherein each of the M video frames selected as the M reference frames is computed based on the same frame of original video.

7. (original) The method of claim 4, wherein the block differences for the M reference blocks are combined for providing a weighted sum having a plurality of weighting factors, and wherein each weighting factor in the weighted sum is determined at least partially based upon a quantizer parameter or the index of the reference frame subjected to that weight.

8. (previously presented) The method of claim 4, wherein each of the M video frames selected as the M reference frames is computed by decoding the same frame of original video at a variety of quality settings.

9. (original) The method of claim 5, wherein motion is represented by a motion vector to be encoded in bits, and wherein said determining is also based on the number of bits needed to encode the motion vector.

10. (original) The method of claim 5, wherein the set of M reference frames is divided into N sub-sets, such that each of the M reference frames belongs to precisely one of the N sub-sets, and wherein the process of determining the optimal horizontal offset X and vertical offset Y is repeated for each of said N sub-sets of reference frames, for indicating a set of N optimal horizontal offsets X and N vertical offsets Y.

11. (original) The method of claim 5, wherein said determining of the optimal horizontal offset X and optimal vertical offset Y involves a discrimination against offsets with large magnitudes.

12. (original) The method of claim 11, wherein the discrimination is at least partially dependent upon an index corresponding to which of the M reference frames is being considered.

13. (original) The method of claim 10, where the number N may vary from one frame of video to another frame of video.

14. (original) The method of claim 11, where the number N may vary from one frame of video to another frame of video, and the determination of the number N involves analysis of block differences in the previous frame.

15. (previously presented) The method of claim 4, wherein for each rectangular block, the set of M reference blocks is divided into N sub-sets, such that each of the M reference blocks belongs to precisely one of the N sub-sets, and wherein the process of determining the optimal horizontal offset X and vertical offset Y is repeated for each of said N sub-sets of reference blocks, for indicating a set of N optimal horizontal offsets X and N vertical offsets Y.

16. (original) The method of claim 15, wherein the number N of sub-sets may vary from one block to another within the given frame of video, said variation either based upon explicit signaling in the encoded bit stream or upon a deterministic algorithm.

17. (original) The method of claim 16, wherein the size of a rectangular block in one of the N sub-sets is computed at least partially using the size of a rectangular block in another of the N sub-sets or the values of the horizontal offsets X and vertical offsets Y.

18. (canceled)

19. (canceled)

20. (previously presented) The device of claim 21, wherein said forming comprises:
    obtaining M additional rectangular blocks of coefficients for providing M reference blocks, for each of said rectangular blocks of coefficients and each permutation

of a horizontal offset value X and a vertical offset value Y, wherein each of said M reference blocks of coefficients is formed by selecting coefficients from the M reference frames, such that the coefficients in the M reference blocks of coefficients are horizontally offset by distance X and vertically offset by distance Y from a corresponding coefficient in said rectangular block of coefficients.

21. (currently amended) An apparatus encoder, comprising:

a motion estimation module, responsive to an input signal indicative of an original frame in a video sequence, for providing a set of predictions so as to allow a prediction module to form a predicted image, wherein the video sequence including a plurality of video frames, each frame containing a plurality of coefficients at different locations of the frame; and

a combining module, responsive to the input signal and the predicted image, for providing residuals for encoding, wherein the motion estimation block is configured for

selecting M reference frames for a given original video frame in said plurality of video frames, wherein M is a positive integer equal to or greater than 1;

partitioning said original video frame into rectangular blocks of coefficients; and from each of the M reference frames:

forming at least one reference block of coefficients from an offset of the rectangular blocks; and

obtaining a block difference at least partially from a summation of absolute values of differences between corresponding individual coefficients in [[in]] each of said rectangular blocks of coefficients and corresponding individual coefficients in said at least one reference block of coefficients and

optimizing the offset at least partially based on the block difference.

22. (currently amended) The device apparatus of claim 21, wherein said optimizing comprises the step of:

determining, for each of said rectangular blocks of coefficients, an optimal horizontal offset X and vertical offset Y, wherein said determining is based at least partially on minimizing a weighted sum of M block differences.

23. (previously presented) A computer readable medium having embedded therein a software program, said software program comprising:

programming codes for carrying out the method according to claim 4.

24. (canceled)

25. (previously presented) The computer readable medium of claim 23, wherein said forming comprises:

a code for obtaining M additional rectangular blocks of coefficients for providing M reference blocks, for each of said rectangular blocks of coefficients and each permutation of a horizontal offset value X and a vertical offset value Y, wherein each of said M reference blocks of coefficients is formed by selecting coefficients from the M reference frames, such that the coefficients in the M reference blocks of coefficients are horizontally offset by distance X and vertically offset by distance Y from a corresponding coefficient in said rectangular block of coefficients.

26. (canceled)

27. (previously presented) The computer readable medium of claim 26, wherein said optimizing comprises:

determining, for each of said rectangular blocks of coefficients, an optimal horizontal offset X and vertical offset Y, wherein the determination is based at least partially on minimizing a weighted sum of M block differences.

28. (currently amended) The computer readable medium of claim [[24]] 23, wherein the block differences for the M reference blocks are combined for providing a weighted sum having a plurality of weighting factors, and wherein each weighting factor in the weighted sum is determined at least partially based upon a quantizer parameter or the index of the reference frame subjected to that weight.

29. (currently amended) The computer readable medium of claim [[24]] 23, wherein the set of M reference frames is divided into N non-overlapping subsets, and wherein the code for determining the optimal horizontal offset X and vertical offset Y repeats the

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process for each of said N sub-sets of reference frames, for indicating a set of N optimal horizontal offsets X and N vertical offsets Y.

30. (previously presented) The computer readable medium of claim 25, wherein for each rectangular block, the set of M reference blocks is divided into N non-overlapping sub-sets, and wherein the code for determining the optimal horizontal offset X and vertical offset Y repeats the process for each of said N sub-sets of reference blocks, for indicating a set of N optimal horizontal offsets X and N vertical offsets Y.

31. (new) The method of claim 6, wherein M is greater than 1 and the block differences for the M reference blocks are combined for providing a weighted sum having a plurality of weighting factors, and wherein each weighting factor in the weighted sum is determined at least partially based upon residual energy of a previous video frame.